# Sampling plan criteria for the bottom mud characterization of a drainage channel

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- ***Defining the optimum sampling strategy for environmental remediation projects with a cost-based approach***

**Is it a classical support dimension - sampling density - estimates precision problem?**

**Lack of specific instructions regarding the support choice** in matter of environmental remediation

The costs associated to the unselected blocks (under-estimation) largely depend on fines and legal expenses, not easily evaluable

*Co = cd * No* The cost due to overestimation (*Co*) is the unitary transport/disposal cost (*cd*) of overselected units (*No*);

*Cu = Cf+Ct+cd * Nu* The cost due to underestimation (*Cu*) depends on a constant subjective term (*Cf*,*Ct*,fine, trial) and the the erroneously unselected units (Nu)

Cut-off choice. Is it preferable to avoid underestimations in a cost-based analysis?

No and Nu depend on estimation precision (which in turn depends on sampling density) and on the support upon which the cut-off grade is defined:

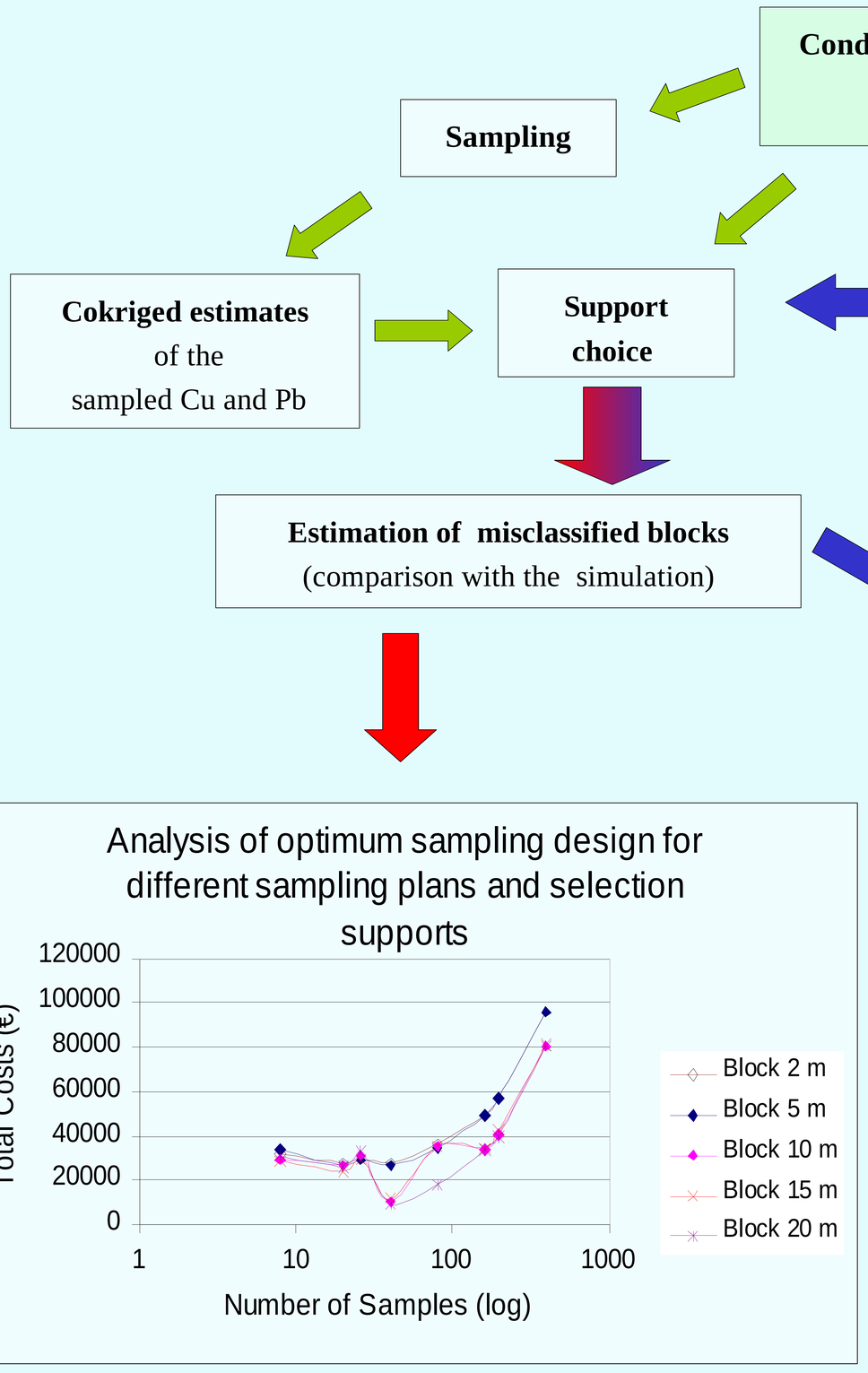
the problem is **bivariate**

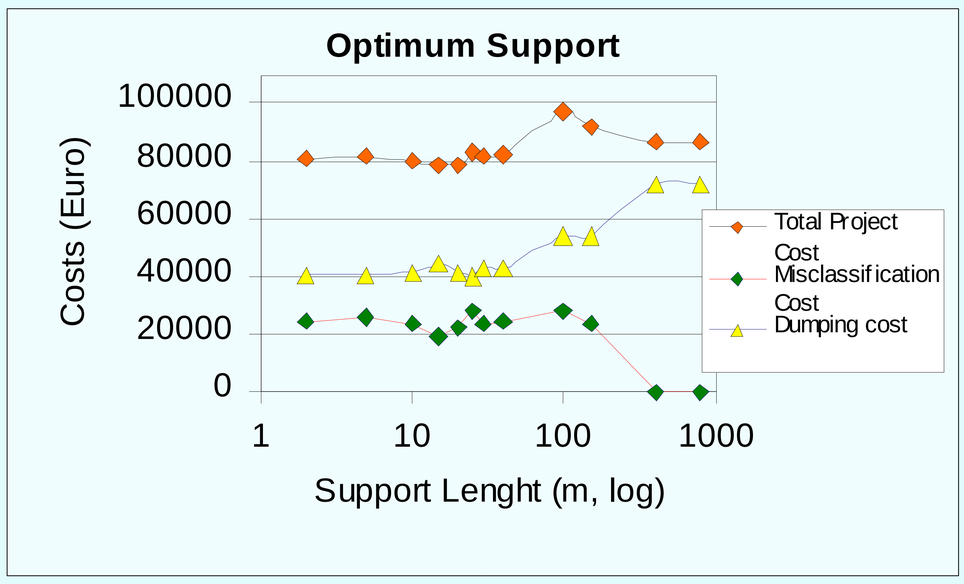
- ***The case study*** - located in Emilia Romagna, Italy, north of Bologna

The studied draining channel is about 800 m long and an industrial dumping discharges in the first part of it. The layer subjected to dredging is 30 cm thick; 36 samples were analyzed, the half of them being representative of the underlying thickness. Elements and pollutant found: Co, Cr, V, Rb, Zn, Cu, Pb …

We focused on Cu and Pb only, *as if* they were the only decision-driving elements.

We considered the cut-off grades imposed by European norms




Minimizing the cost functions we obtain the optimum number of samples (40 for a channel length of 800 m) and the unexpected indication (for E[Cu]>CutOff) that the small supports are not advantageous from an economic point of wiew

For the actual sampling (18 samples) the optimum support choice is therefore nearby 15 m: an estimation of the project is then around 80000 Eur.